

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

Research Briefs

U.S. Department of Agriculture

Agricultural Research Service

January - March 1990

Inside

- Ice cream sheds its high-fat image to become a low-cal frozen dessert with a healthy helping of oat fiber.—p. 3
- Researchers now have a way to detect even a mild iron deficiency in infants and children.—p. 2
- Fructose sugar may hold blood sugar levels down, but it has troubling side effects.—p. 2
- Knowing what compounds give pineapples their fresh flavor could mean better tasting pineapple-based foods.—p. 3
- Still leaner pork could be on the horizon.—p. 3

Nutrition and Health

A very low boron intake has again been shown to cause brain wave changes like those that occur when a person becomes drowsy. The latest evidence—from a 6-month study of 13 women—supports earlier findings that when dietary boron is dramatically reduced, there are distinct changes in EEG's (electroencephalograms). The low-boron diets contained no fruits or natural fruit juices and only a few vegetables in very small portions. In addition, further results from the earlier study indicate that boron deficiency seems to have an effect on motor performance. Women in this study group could not tap their finger as fast, track a target as accurately with a joy stick or respond as quickly when asked to search a field of letters for specific items. Boron is most abundant in apples, pears, grapes and several vegetables. So fast-food fare, even with a lettuce and tomato salad, would not contain much of the element.

*Grand Forks Human Nutrition Research Center
Grand Forks, ND*

James G. Penland, (701) 795-8471

Fresh broccoli—a salad bar favorite—is an excellent source of vitamin C. Recent analyses show that four ounces has as much vitamin C as an 8-ounce glass of frozen reconstituted orange juice—about 100 milligrams. If the florettes are a very fresh, deep bluish-green, they could contain an

extra 40 mg. But freezing and cooking slash vitamin C content more than half, researchers found. And, contrary to popular belief, it doesn't matter how long broccoli is cooked or how much water is used. Most of the loss occurs in the first few minutes of boiling, so blanching does not conserve the vitamin. Nor does steaming: Vitamin C loss was the same in 1/4 cup of boiling water as in 4 cups. The analyses also show that broccoli's vitamin C content at the dinner table is probably lower than USDA food composition tables and other lab-derived values, for which vegetables are cooked in distilled water. Metals in tap water destroy some of the vitamin—about 20 percent according to limited analyses.

*Beltsville Human Nutrition Research Center
Beltsville, MD
Joseph. T. Vanderslice, (301) 344-2370*

The classic physical effects of alcoholism may be due to too little copper in the diet in combination with too much alcohol. Recent findings with rats indicate that it takes both of these dietary factors to cause the damaged heart muscle, anemia, fatty liver and high levels of toxic by-products so characteristic in alcoholics. Animals that got adequate copper in their feed did not develop these complications nor die prematurely from drinking 20 percent alcohol in lieu of water as did those on a copper-deficient diet. While the low copper and high alcohol levels were more severe than we normally experience, the findings have long-term implications for people who like to imbibe because rats metabolize food and drink much the same as people do. And most Americans get less than the minimum suggested intake of 1.5 milligrams of copper each day. Oysters, liver, cocoa, blackstrap molasses and black pepper are rich sources of the mineral; lobster, nuts and seeds and whole wheat bran are good sources.

*Beltsville Human Nutrition Research Center
Beltsville, MD
Meira Fields, (301) 344-2417*

It's no wonder researchers have had difficulty nailing down a suspected link between low copper intakes and coronary heart disease. The latest findings indicate people's genetic makeup—in addition to their sex and the types of proteins and carbohydrates in test diets—may influence how they respond to short periods of inadequate copper. When 10 men got less than half the suggested copper intake for 6 weeks, 4 of them responded with a

significant increase in cholesterol—at least 7.5 percent—primarily in the undesirable LDL cholesterol. Also, their blood platelets—the “quarterbacks” of clotting—got larger and stuck together more readily, which is thought to contribute to the formation of atherosclerotic plaques. But the other 6 men didn’t show these symptoms. In fact, their cholesterol levels went down during some of the low-copper period. The two groups also had opposite changes in levels of hormones involved in blood sugar metabolism. All 10 of the men, however, showed early signs of copper deficiency based on a very sensitive test. Despite the inconsistencies, many of the changes indicate that a longer period of copper depletion could be detrimental to human health. The men consumed only 0.65 milligram of copper each day compared to the suggested intake of at least 1.5 mg/day. An estimated 35 percent of Americans get only 1 mg/day or less.

*Grand Forks Human Nutrition Research Center
Grand Forks, ND
David Milne, (701) 795-8424*

Even a mild case of iron deficiency in infants and children can be detected in its early stages with a new test that’s easy to administer for research studies. Marginal iron deficiency is a worldwide problem for high-risk groups such as children, adolescents and women of child-bearing age—particularly pregnant women. The new test requires only a drop of blood, taken by pricking the finger. Current tests require about one-third of a teaspoon drawn by a needle from a vein. The new test measures the number of receptors in blood plasma for a protein known as transferrin. Transferrin, which delivers iron through the bloodstream, releases it inside a body cell after passing through the receptors. The number of receptors correlates to the presence or absence of iron deficiency. This research tool is also useful in studying the body’s need for iron at various developmental stages so doctors and nutritionists can make recommendations to increase or limit dietary iron.

*Children’s Nutrition Research Center, Houston, TX
Buford Nichols, (713) 798-7000*

Certain carbohydrates should reduce a person’s chance of developing diabetes because they keep blood glucose and insulin levels from spiking after a meal. Both fructose and high-amylose starch have shown this dampening effect in a number of studies. To find out which of these two carbohydrates is better at improving glucose tolerance, 21 men, 10 of whom had elevated insulin levels foreboding diabetes, volunteered to find out. They ate one or the other of the carbohydrates as part of breakfast, lunch and dinner for 5 weeks each. The fructose-containing meals were most effective at holding glucose and insulin in check in all the men. But, the meals tended to reduce insulin’s efficiency in the 10 men with high insulin. And triglyceride, LDL cholesterol and uric acid—all risk factors

for heart disease—were higher in these men when fed fructose-based meals. This suggests that the benefits of fructose probably don’t outweigh the risks to those who are already have elevated insulin.

*Beltsville Human Nutrition Research Center
Beltsville, MD
Sheldon Reiser, (301) 344-2396*

Add a little spice to your life; it may improve your blood sugar level. Tests show that cinnamon, apple pie spice, cloves, bay leaves and turmeric can do more than just enhance the flavor and aroma of food. Extracts of each of these spices tripled insulin’s performance in getting glucose metabolized in a widely used test tube assay of insulin activity. Researchers have purified the active ingredient in cinnamon to about 95 percent, but don’t yet know what it is. How much of these spices are needed to improve a person’s blood sugar level is also unknown because human studies have not been done. But adding some extra spice to healthful foods certainly won’t hurt.

*Beltsville Human Nutrition Research Center
Beltsville, MD
Richard A. Anderson, (301) 344-2091*

Athletes who get recommended levels of copper, iron and zinc through their diets—and many of them do—don’t need to take supplements. These essential trace elements help regulate the body’s use of energy and thus take on added importance during physical training. A 6-month study of college men and women found that, during intense training, competitive swimmers didn’t need more of the elements than nonathletic students. Blood indicators of copper, iron and zinc were normal for both groups and didn’t change throughout the athletes’ training period. The collegians in this study got their essential nutrients from food, not supplements.

*Grand Forks Human Nutrition Research Center,
Grand Forks, ND
Henry C. Lukaski, (701) 795-8429*

The latest report to Congress on USDA’s human nutrition research and education activities covering fiscal year 1989 is now available. For a free copy, write to Dr. Gerald Combs, Rm. 132, Bldg. 005, BARC-West, Beltsville, MD 20705.

Tomorrow's Foods

Cholesterol-conscious consumers with a craving for ice cream could soon get a triple bonus from a new product that reduces the fat and calories in America's favorite dessert while fighting blood cholesterol. The new product, dubbed oatrim, is made from soluble oat fiber. And because it replaces most of the saturated fat, it turns ice cream into a low-calorie, low-fat frozen dessert without sacrificing taste. A 4-ounce serving of vanilla oatrim frozen dessert has 135 calories, less than 1 gram of fat and 4 milligrams of cholesterol. By comparison, a similar serving of premium vanilla ice cream has 298 calories, 22 grams of fat and 85 mg of cholesterol. Oatrim can easily be used in a variety of other dairy products and prepared foods, including yogurt, breads, cookies, salad dressing, sour cream and mayonnaise without affecting taste, texture and appearance. Preliminary tests at Montana State University with 10-day-old chicks showed an oatrim diet reduced elevated blood cholesterol 17.8 percent. The chicks' LDL cholesterol—the undesirable kind—dropped 47.4 percent while the beneficial HDL cholesterol increased 17.7 percent.

*Northern Regional Research Center, Peoria, IL
George E. Inglett, (309) 685-4011*

More lean pork was produced by all 24 pigs given an experimental feed additive, ractopamine. The biggest gain in lean meat and greatest fat reduction were in an experimental strain of pigs that normally produce fatter meat on a low protein diet. When these animals reached 200 pounds they had 17 percent more protein and 31 percent less fat in their muscle tissue than a control group fed the same rations without ractopamine. These results suggest that a farmer could use the additive to boost the production of leaner hogs. Developed by a private firm, ractopamine has yet to be approved by the Food and Drug Administration for on-farm use.

*Non-Ruminant Animal Nutrition Lab, Beltsville, MD
Alva D. Mitchell, (301) 344-2868*

Waste from electric generating plants may be a potential fertilizer for crops used for livestock feed. Pigs were safely fed mixtures of corn, wheat and soybeans originally fertilized with electric power plant residues. These wastes came from power plants using fluidized bed combustion of coal, a process that significantly reduces acid rain pollution. Neither the pigs' blood nor body tissues tested at the end of the study showed any unusual or harmful concentrations of chemicals. In fluidized bed combustion, finely ground limestone is mixed with coal and suspended in a combustion chamber by jets of air. Part of the coal doesn't burn and combines with calcium in the limestone to form a solid residue. Sulfur, lime and other chemicals in the residue can be used to fertilize crops.

*U.S. Regional Pasture Research Lab, State College, PA
William L. Stout, (814) 863-0947*

Food and Water Freshness and Safety

The sweet, light flavor of high-quality fresh pineapple is largely the work of nine aroma compounds. In tests using sophisticated lab devices and a "sensory panel" of volunteers, one of these natural chemicals, ethyl 2-methylbutanoate, was so potent that the nose could detect it at 6 parts per trillion. That's equivalent to six grains of sugar in an Olympic-size swimming pool. Researchers ranked the nine compounds so producers of pineapple-based foods can use them to objectively check quality. The ranking can also guide development of superior pineapple varieties through conventional breeding or genetic engineering.

*Western Regional Research Center, Albany, CA
Gary R. Takeoka, (415) 559-5668*

Routine pasteurization protects milk from *Listeria monocytogenes*, a bacterium incriminated in food-poisoning outbreaks in the United States and Canada. A joint study by ARS and the Food and Drug Administration verified that pasteurization kills the *Listeria* microorganism that causes a potentially fatal intestinal disease, listeriosis. The pathogen had never been found in pasteurized milk. But a 1983 outbreak incriminated milk purchased from a supermarket chain as the source. Researchers tested bacterial strains isolated from the outbreak and found they did not survive pasteurization. *L. monocytogenes* organism is known to be able to grow during chilled storage and can infect cooked and ready-to-eat products. The organism often occurs in raw milk and vegetables, cheese, ice cream, fermented sausages and seafood. Listeriosis victims often believe they just have the flu and don't seek medical help. High-risk groups include adults with weakened immune systems as well as newborns and unborn fetuses.

*National Animal Disease Center, Ames, IA
Irene V. Wesley, (515) 239-8291*

More on *Listeria*... In studies of fresh beef, researchers stopped *Listeria monocytogenes* growth for 28 days under normal refrigeration by first dipping the meat in a diluted solution of bacteriocin. They then challenged the meat with *Listeria* every 7 days. Bacteriocin is derived from a starter culture used in making some fermented meat products such as pepperoni and summer sausage. Some processed meats are already being inoculated with bacteriocin-producing bacteria. The compound, not yet approved in its pure form, is similar to nisin, which the Food and Drug Administration has approved as a food additive. Besides causing disease in humans, *L. monocytogenes* is known to be a pathogen of warm-blooded animals, causing meningitis, encephalitis, abortion and occasionally a blood infection. The pathogen has also been identified in birds and fish. The next step will be to isolate and characterize bacteriocin's anti-bacterial spectrum.

*U.S. Meat Animal Research Center, Clay Center, NE
Jerry W. Nielsen, (402) 762-4223*

Just because peanuts are big, doesn't mean they are mature on the inside—even though kernel size is currently used as a basis for marketing. ARS scientists found that physical characteristics and chemical reactions inside the kernel differ when roasting immature and mature peanut kernels. Immature kernels tend to be darker than mature kernels when roasted and have less potential for full flavor. Factors such as protein, carbohydrate and oil levels can affect peanut flavor, and the proper balance in composition and quantity is essential. Ultimately scientists want to determine the optimum balance of these components needed to produce better-tasting roasted peanuts. Understanding the connection between maturity and flavor should help the peanut industry produce a more uniform product.
National Peanut Research Lab, Dawson, GA
Timothy H. Sanders, (912) 995-4441

Food processors can use a new ARS computer program to drastically cut the number of lab tests now required to monitor bacterial levels in foods. While not 100 percent accurate, the computer program could cut by 75 percent the number of tests needed to test for *Salmonella* and *Listeria*—two food-poisoning bacteria found in meat and dairy products. It predicts how factors such as acidity and salt influence bacterial growth. The program is being refined so it can also track the bacteria *Shigella*, *Aeromonas* and *Staphylococcus*. About 300 companies are interested in using it.
Microbial Food Safety, Philadelphia, PA
Robert Buchanan, (215) 233-6620

Encapsulating pesticides or working them into soil can greatly reduce groundwater pollution on no-till fields. A 3-year study in Maryland showed that in dry years pesticide levels in groundwater were well within the Environmental Protection Agency's health advisory levels, on both no-till and conventional-till cornfield plots. But in a year of normal rainfall, water underlying no-till plots had significantly higher concentrations of carbofuran insecticide and the herbicides alachlor, atrazine and cyanazine than water underlying conventionally tilled plots. The most worrisome results came during May 1988 when 2 inches of rain fell over 2 days, beginning just 12 hours after the herbicides were sprayed on the field and a few days after carbofuran had been worked into the soil. Both atrazine and cyanazine levels for both types of tillage were significantly higher than EPA advisory levels. Using alachlor-encapsulated pellets—which allows for slow release, increased efficiency and reduced loss of the herbicide—resulted in much lower levels. Incorporating carbofuran into the soil in a narrow band had the same effect. Exposing it to less soil lowers the odds of its being washed into an underground shortcut to groundwater.
Hydrology Lab, Beltsville, MD
Tim J. Gish, (301) 344-4378

A hormone called cytokinin may hold the key to slowing down the natural aging of plants. Vital clues about how to boost cytokinin levels and further delay aging may come from experiments by ARS scientists using new monoclonal antibody probes. The researchers have applied for a patent for the probes, which may reveal how to trick plants into prolonging their growth by using more of the inactive form of cytokinin that is stored by the plant. This longer life would give plants like wheat a little extra time to pack more rich nutrients into each kernel, increasing crop value.
Western Regional Research Center, Albany, CA
David L. Brandon, (415) 559-5783
Joseph W. Corse, (415) 559-5758

A live, genetically engineered intestinal bacterium has been used in an experimental vaccine to fight coccidiosis in chickens. Administered orally, the harmless, altered bacterium *Escherichia coli* gave chickens significant protection against this deadly parasite. Initial tests results may provide leads to developing effective vaccines against avian coccidiosis, which costs U.S. poultry farmers \$300 million annually for medication and lower weight gain in chickens. Genes from the coccidial parasite were inserted into a strain of the common intestinal bacteria *E. coli*. When chickens were inoculated with the new bacterium, it could not reproduce but the chickens produced immune cells in response to it. Then, when the birds were infected with the coccidia parasites, the immune cells killed up to 70 percent of the parasites.
Biosystematics Parasitology Lab, Beltsville, MD
Mark C. Jenkins, (301) 344-8054

The Briefs is published quarterly in January, April, July and October. For further information or addition to the mailing list, contact Judy McBride, ARS Nutrition Editor, at (301) 344-4095; or write to me at ARS Information, Bldg. 005, BARC-West, Beltsville, MD 20705.